

Midland Metro - City Centre
Extension & Fleet Replacement

Option Development

Version v3.0

October 2009

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1 Introduction

Context

- 1.1 The proposed extension to Midland Metro from Snow Hill Station to Birmingham New Street Station has been developed over a number years. As part of this process a range of options has been considered, leading to the identification of the preferred scheme.
- 1.2 As part of the proposed Phase 1 Extensions to Midland Metro different options were assessed for the scheme from Snow Hill through the city centre to Edgbaston. This work confirmed the selection of light rail for the preferred scheme.
- 1.3 Subsequently a review of the scheme was undertaken. This led to the recommendation of prioritising investment to improve connectivity within Birmingham City Centre, specifically for New Street Station. This in effect is a lower cost alternative to the original proposed Line 1 extension, addressing the issue of scheme affordability.
- 1.4 Building on the original option development work a further assessment stage was undertaken in order to address the change in scope and characteristics for the scheme and to confirm, or otherwise, that the proposals are justifiably retained as the preferred scheme.

This Note

- 1.5 This note provides an overview of the option development process that identified the Midland Metro extension as the preferred scheme. The next chapter provides a review of the original work undertaken as part of the development of Midland Metro Phase 1 Extensions. Chapter 3 presents a summary of the consideration of options that was undertaken following the recommendation to re-scope the original scheme. Chapter 4 sets out confirmation of the robustness of the proposals for the earlier replacement of the Midland Metro fleet as part of the overall scheme.

2 Midland Metro Phase 1 Extensions

Introduction

- 2.1 Centro and WMPTA originally had plans to develop and construct a three-line Midland Metro network. Midland Metro Line 1 was planned to run from Wolverhampton to Birmingham city centre whilst Line 2 was planned to run from Birmingham city centre to Birmingham International Airport and the National Exhibition Centre. Line 3 was planned to run from Wolverhampton to Walsall, Wednesbury, Dudley and Brierley Hill.

Phase 1 Network Extensions

- 2.2 Following the decision to proceed with the implementation of Line 1 in 1995, Centro and WMPTA considered how best to develop the remainder of the three line network.
- 2.3 Due to the high cost of construction of both Lines 2 and 3 and the uncertainties over the availability of funding, WMPTA decided that the expansion of the Midland Metro network should be carried out in an incremental manner. This approach led in 1995, to the 'Bite Sized Chunks Initiative'. The purpose of this initiative was to identify those parts of the proposed additional network, the Phase 1 extensions, for which a strong transport and economic case could be made at an early date and that would stand a realistic chance of securing Government funding.
- 2.4 This initiative identified three potential extensions. These were:
- Birmingham City Centre Extension (BCCE);
 - Wednesbury to Brierley Hill Extension (WBHE); and
 - Wolverhampton town (now city) centre Loop.
- 2.5 The BCCE scheme was for a 3.2km extension from Snow Hill Station to Edgbaston. As part of the process to identify and develop the proposals an examination of a range of options was undertaken. In defining the options cognisance was taken of the scheme objectives, which included:
- Providing a high quality public transport service;
 - Improving accessibility to and within the transport corridor and the urban centres; and
 - Supporting the economic, environmental and social objectives for Birmingham city centre including its role as a World City and heart of the City-Region.

Options Considered

- 2.6 The options considered addressed the requirements of penetrating the city centre and integrating with the existing public transport network, as well as supporting Birmingham City Council's proposals for recasting the bus network and introducing increased pedestrianisation.

2.7 Two broad categories of options were assessed. They were:

- Rail-based:
 - Light rail, with some tunnelled sections;
 - Light rail, on-street throughout; and
 - Shorter route option.
- Bus-based:
 - Wire guided trolley bus; and
 - Additional bus services.

Rail-Based Solutions

- 2.8 Based on previous work by Centro and Birmingham City Council considering underground running it was concluded that tunnelled solutions would be prohibitively expensive¹. In addition, it was identified that access to underground stops would be undesirable from the point of view of users in terms of convenience and security. It would also be difficult to provide good interchange and integration with new city centre developments.
- 2.9 In comparison on-street running offers a more environmentally attractive solution and stronger integration potential with land use developments, as well as being more accessible than an option with underground stops. An additional advantage considered for on-street running is its greater potential for securing developer contributions and other funding and providing a visual symbol for a world class city.
- 2.10 A third option that was considered for light rail was the shortening of the proposed route so that it terminated at New Street Station rather than Edgbaston.

Bus-Based Solutions

- 2.11 The non-LRT options considered encompassed a wire guided trolley bus option and additional bus services. The wire-guided trolleybus was identified as being the closest equivalent system to light rail. It combines the features of a conventional bus, but without the emissions resulting from diesel engines. In addition, the trolleybus would require overhead power lines in common with light rail although these could be expected to be more intrusive for trolleybus operation.
- 2.12 The introduction of a trolleybus (or any other non-LRT mode) would require an interchange for passengers arriving on Midland Metro Line 1 at Snow Hill Station and seeking to continue their journey. This would be a significant impediment compared with an option offering a seamless onward journey, i.e. an extension to Midland Metro.

¹ *Proof of Evidence of Andrew Gardner: Scheme Development and Implementation, Transport and Works Act 1992 Midland Metro (Birmingham City Centre Extension, etc) Order Inquiry* (November 2003) (CP4) section 4.

- 2.13 Additional considerations for introducing a trolleybus service reflected the challenge that would be presented in attracting investors and operators given the relatively small scale of the scheme and its unproven technology due to no trolleybus systems having been introduced in the UK in recent years.
- 2.14 With respect to developing an option framed around conventional bus services it was considered that such an option would not meet the objectives identified for the scheme and would conflict with the City Council's ambitions for recasting the bus network in order to remove services from some areas to enable an expansion of the pedestrianised core. Given the Council's priorities it was not considered feasible to promote a conventional bus alternative to light rail. This position was tested thoroughly and accepted by the Inspector at the Public Inquiry.

Other Considerations

- 2.15 Other considerations that were taken account of in the process of reviewing options and identifying the preferred scheme reflected the status of the planning condition for the development at Snow Hill and the provision of infrastructure in the form of the viaduct for a Midland Metro extension.

Conclusions

- 2.16 The conclusions that emerged from the option development process that determined the BCCE scheme as the preferred option can be summarised as:
- An extension of Line 1 to the city centre will provide new journey opportunities with good interchange facilities and integration;
 - Light rail through the city centre would be most supportive of broader central Birmingham initiatives and hence most acceptable to Birmingham City Council;
 - Guided wire trolleybus, the closest equivalent to light rail, is very unlikely to be procured;
 - Guided wire trolleybus (or any other non light rail mode) would impose an interchange penalty for through passengers at Snow Hill;
 - The route alignment through the Snow Hill development has been secured as a planning condition for the site; and
 - Delivering the strongest fit with the LTP through:
 - Providing accessibility to the heart of the city as part of the pedestrian and environmental enhancement of the city centre;
 - Full integration with the Bus Mall serving the city centre;
 - Improved access to existing and major new developments in the centre and the south west sector of the city; and
 - Integration with main line rail services at New Street and Snow Hill Stations.

3 City Centre Extension to New Street Station

Introduction

- 3.1 In 2008, Birmingham New Street Station received funding approval for the Birmingham Gateway scheme and Birmingham City Council published its 'Big City Plan'. Together these provided a new perspective on how city centre regeneration will take place over the next few years and highlighted the priority for transport investment in the heart of Birmingham. Therefore, Centro and the City Council examined how the BCCE proposals could be adapted to reflect the transport needs of proposed developments, as well as continuing to meet the existing public transport needs of the city as a whole.

Option Consideration

- 3.2 Consideration of the potential options has been undertaken in the context of the objectives for the scheme, which are informed by the national, regional and local policy agenda, and the current and proposed transport services within Birmingham city centre. Additionally, the work previously undertaken as part of the option development process for the Midland Metro Phase 1 Extensions was considered.
- 3.3 The scheme objectives are to:
- Support the growth and competitiveness of the economy of Birmingham and the West Midlands through improving connectivity, increasing capacity, reducing congestion and supporting the viability of existing and new city centre developments;
 - Support the sustainable growth of Birmingham, and contribute to tackling climate change, through reducing the carbon impact of transport;
 - Promote equality of opportunity by enhancing access to jobs and enabling greater participation in a range of leisure, retail and health activities through improving transport accessibility between the city centre and some of the most deprived areas of the West Midlands;
 - Contribute to the achievement of local air quality targets, and improvements in the Birmingham AQMA; and
 - Contribute to improving the overall safety, security and health in the West Midlands, through reducing accidents and improving security on the public transport network.
- 3.4 Based on previous work and the objectives for the scheme it was determined that it would not be plausible to develop an option that offered a technology variation to the option of extending Midland Metro to New Street Station. As identified for the trolleybus, an option based on a technology not compatible with the existing Midland Metro Line 1 would:
- Ensure the need for through passengers to interchange;

- Be unlikely to receive support from Birmingham City Council due to conflicting with their urban realm and pedestrianisation aspirations; and
 - Be unattractive to potential investors and operators due to its short route length.
- 3.5 Furthermore if untried or innovative technologies were considered there would be considerable deliverability risk, which in the central area of the city that provides the economic hub for the West Midlands and is the UK's second city could have significant negative impacts.
- 3.6 The implications of the above findings are that an alternative technology to Midland Metro providing a like-for-like service to the proposed extension to New Street Station would not strongly support the scheme objectives. As a result of imposing an interchange penalty on passengers the anticipated demand would be significantly lower than for a Midland Metro extension, and hence the contribution to tackling the DaSTS inspired objectives in relation to climate change, economic sustainability, equality of opportunity and safety and health would be limited.
- 3.7 Therefore identification of options for comparison against the revised Midland Metro option, in effect it already being a lower cost alternative to the original proposals (due to terminating at New Street Station rather than Edgbaston) sought to consider other ways to meet the scheme objectives and deliver the forecast benefits. The two options identified were a bus shuttle and investment in active modes.
- 3.8 The introduction of a shuttle bus providing connectivity between city centre destinations and linking Snow Hill Station with New Street Station would go some way to addressing some of the scheme objectives, e.g. improving access, supporting local air quality targets (if it ran on clean fuel). Bus technology is also, clearly, a tried and tested technology and a shuttle service could potentially be integrated within the wider bus network.
- 3.9 However, recent experience suggests the limitations of such an option. A few years ago a Station Link bus service operating between Snow Hill Station, Moor Street Station, New Street Station and Digbeth Coach Station was discontinued due to the lack of patronage and the cost of operation. This in part reflects the interchange requirement of transferring between modes, the imposed routing due to the one way system and traffic congestion in the city centre. This all contributed to relatively lengthy journey times reducing the attractiveness of the service and the more general reduced attractiveness of bus based transport compared to rail based options.
- 3.10 The assessment of a bus shuttle option also identifies its poor performance in terms of addressing the scheme objectives to support economic competitiveness and equality of opportunity due to its failure to deliver through connectivity (i.e. without the need for interchange) between major employment centres and areas along Line 1 characterised by deprivation.
- 3.11 Similarly the introduction of a new bus service would run counter to the City Council's intentions for the removal of traffic and expansion of pedestrianisation in central Birmingham.
- 3.12 An option based upon investment in active modes was also considered. This would improve the pedestrian environment through measures to improve legibility and encourage greater walking and cycling in central Birmingham. Such an option would

be a continuation of the investment that has taken place to date on signage and cycle parking etc. It would therefore make a positive contribution to the transport offer and support the objectives of the scheme to some extent.

- 3.13 However, it would not deliver the step change that is being sought in order to achieve the status of a world class city for Birmingham and in not doing so it would not significantly address the scheme objectives. For example the investment in active modes would do little to encourage modal shift leaving air quality issues unchanged. It would also not promote social inclusion or support economic growth through expanding the labour catchment area.

Conclusion

- 3.14 The process of considering options to meet the scheme objectives and address identified problems identified the extension of Midland Metro from Snow Hill Station to New Street Station as the preferred scheme.

4 Earlier Replacement of Midland Metro Fleet

Introduction

- 4.1 In developing the current scheme, a number of alignment and procurement options have been considered in deriving the current Do Something projects. These have centred around the issue of the replacement of the current trams and options to refurbish and retain them.

Existing Trams

- 4.2 Altram provided 16 Ansaldo T69 trams to operate Line 1. The trams are leased by Centro via Royal Bank of Scotland, and the costs of the lease are funded by the PTA Levy. The trams were designed to operate on Line 1, and to operate on gradients of up to 6.25% to allow for them to be able to operate on the then maximum gradient proposed for the Birmingham City Centre (BCCE) and Wednesbury to Brierley Hill (WBHE) extensions. The trams are 60% low floor and are designed to carry up to 156 passengers.
- 4.3 Ansaldo has provided little support since completion, following which it has become clear that the trams are of a very individual design, with high levels of variation between trams and many hard-to-source components. As an example, the brake discs for the main braking system are fitted to no other rail vehicle in the world.
- 4.4 TWM has done much to remedy the situation by sourcing components through local suppliers and bearing down on maintenance costs and unplanned work. However, little more can be achieved with the T69 fleet without major re-engineering and retrofitting of more reliable components.

Vertical Alignment Issues

- 4.5 The vertical alignment of the Birmingham City Centre Extension has a maximum gradient of 7% on Stephenson Place on the length to New Street Station, and 8% on Pinfold Street on the remaining Transport and Works Act Order alignment.
- 4.6 The gradient issue is a particular safety concern for trams descending an incline, especially in a location such as Stephenson Place where any errant vehicle would collide with the supporting columns of the Pallasades shopping centre. Centro therefore commissioned Knorr Bremse, the widely regarded European brake manufacturer, to undertake a detailed study into the possibilities for the upgrading of the T69 braking system to accommodate the planned gradients on the Birmingham City Centre Extension.
- 4.7 Knorr Bremse carried out a very detailed study of the T69 braking systems and concluded that there was insufficient physical space within the T69 bogie housing to accommodate the larger and more powerful braking systems required to deliver increased braking capability, and that the trams were physically incapable of modification to suit the steeper gradients.

- 4.8 Centro therefore commissioned Mott MacDonald to review the engineering aspects of the vertical alignment in the city centre to see if it was possible to reduce the maximum gradient to allow its use by T69 trams.
- 4.9 Because the current proposal does not include Pinfold Street, the Motts study reviewed only the Stephenson Place alignment. However, it is considered that the topography of the Pinfold Street area would not allow a less steep gradient to be accommodated.
- 4.10 The amendments to the vertical alignment required to provide T69 compatible gradients would necessitate excavation of a further 0.5 metres at the foot of the Pallasades ramp into New Street Station, imposing considerable additional disruption on this very busy pedestrian route into the station and the shopping centre.
- 4.11 In order to design the alignment and achieve the required centreline maximum gradient for T69 trams of 6.25%, a combination of vertical curves and transitions would be required: this is extremely difficult to construct and close to technical limits, and has the potential side effect of restricting new tram supply options as some models of tram may not be able to accommodate the increased torsional fatigue effects. The subsequent decision to design the extension for non T69 vehicles presented the opportunity to relax the gradient constraint, which allows the combined vertical curvature and transitions to be removed and reduces both design costs and potential capital costs of new vehicles.

Replacement Versus Retention

- 4.12 A qualitative analysis was undertaken on the merits of replacement or retention of the T69 trams, the main points of which are reproduced below.
- 4.13 Retention of existing trams would lead to increased operational complexities relating to the following:
- Existing trams have lower capacity than modern replacements, reducing the ability to deal with peak loadings, especially within Birmingham;
 - Because additional vehicles are required and the T69 is no longer manufactured, depot facilities would need to be duplicated to handle two different trams, e.g. two sets of spares/stores, two maintenance procedures, variable access gantries, two sets of special tools, two sets of data retrieval equipment, etc;
 - Driver competence would need to be on two different trams;
 - Service recovery following tram failures may be made more difficult if the two tram types could not be coupled together;
 - Existing trams may be seen as “old and tired” by key stakeholders, e.g. Birmingham CC, Dudley MBC, Westfield and customers;
 - The necessary high levels of performance would be difficult to achieve, because of increasing obsolescence of the existing trams. For key components this is already an issue;
 - Fault attribution will be complicated if full risk transfer not achieved; and

- There would be interoperability difficulties in operations if Line 1 tram braking systems cannot be upgraded to allow them to operate on BCCE, and potentially on any future extensions.
 - Replacement of the existing trams would have the following benefits:
 - There would be a single maintenance facility with economies of scale in the purchase and storage of spare parts;
 - A service provided by a new fleet of trams will increase the attractiveness of the system and add to patronage;
 - Risk transfer to the vehicle maintainer (new operator) would be simpler and better protect Centro from exposure to performance risk; and
 - Increased market interest enhancing the potential for a competitive procurement process for the new vehicles.
- 4.14 Centro also undertook a detailed quantitative analysis of the retain/replace cases. This forms the basis of the Do Something/Do Minimum comparison for the Business Case and showed that the whole-life costs of retention were marginally greater than the costs of replacement.

Conclusion

- 4.15 The early replacement of the Line 1 fleet is better value for money than its retention. Replacement would provide larger capacity vehicles, better able to attract new customers through marketing and retain them through crowding relief. It also provides for a better tramway alignment through Stephenson Place and minimises city centre disruption.